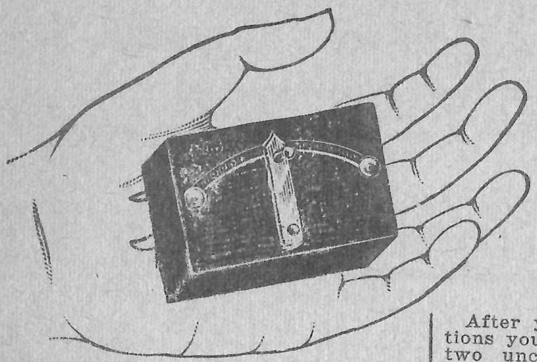
EFFICIENT RADIO SETS

HOW TO MAKE AND OPERATE RECEIVING SETS.

RECEIVE & ENJOY
THE BROADCASTINGS
FROM THE LARGE CITIES,
CONCERTS, MARKET REPORTS ETC

PRICE 50¢



Match Box Radio Set

Easy to Build Fun to Operate

It is easy to build this Match Box Crystal Radio Set. Here are the only parts you need:

Coil of No. 22 Wire.
Fixed Crystal.
Sliding Contact.
Earphones.

The wiring diagram is shown below. Notice how easy the hook-up is!

To construct the **Match Box Radio Set**, first get a match box. Then, using No. 22 varnished copper wire, wind it around the box in a continous coil from one end to the other with no space between the turns.

One end of this coil is dead, that is, it should be insulated and goes nowhere. (See diagram.)

The other end is connected with both the aerial and the fixed crystal.

Across the top of the match box draw a file over the wires leaving them bare in one single straight line. **This is where your sliding contact will rest.**

• For a sliding contact, in order to get a good connection, it is best to use a thumb tack that can be slipped in at any point along this line. It must make a good connection with the **bare part of the wire.**

Connect one wire to the thumb tack; the other end of this wire is connected to the phones and to the ground wire.

After you have made these connections you will find that you will have two unconnected parts: one end of the phone and the fixed crystal. Connect these by means of a wire and your Match Box Radio Kit is ready for operation.

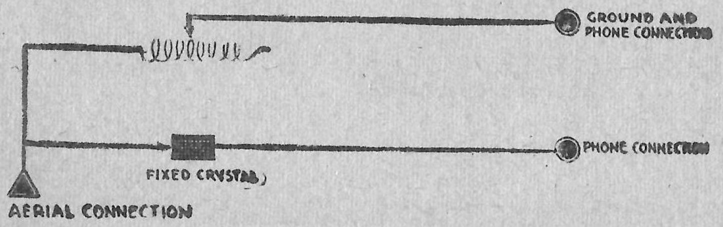
How To Operate These Sets

To operate the set you merely slide the thumb tack across the bare wire until you have good reception. When you reach this point you can insert the thumb tack so that it makes a good connection, and listen to the music as long as you wish.

The fixed crystal fits into the drawer of the match box and the only wires coming out go to **the ground** which consists of a water pipe or an iron pipe driven 6 feet into the ground, **the aerial wire** which must be connected to an aerial at least 50 feet in length, and **the two phone connections.**

This radio will **bring** in stations up to 25 miles away.

Wiring Diagram



A Powerful All-Wave Crystal Set

One Of The Best For Amateurs

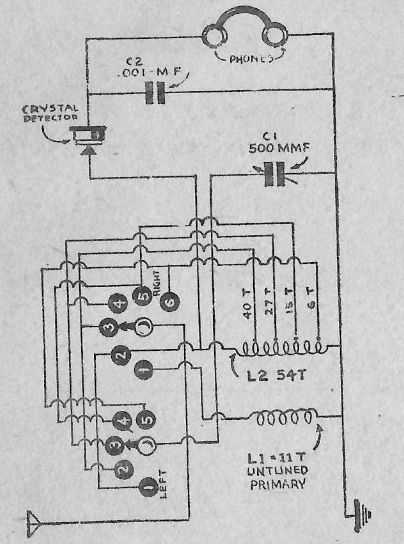


Fig. 1. Schematic circuit of the receiver described.

A new circuit for a super-sensitive, all-wave crystal set using plug-in-coils has been brought out which is much more sensitive and selective.

Using but two plug-in coils, one for each wave band, there is but one basic change in the circuit, as shown in Fig. 1.

A long antenna and a ground connection brought in a 640 kc. station. Lower part of the broadcast band and short-wave are received with as much volume and far better selectivity by using this long outdoor antenna; instead of a ground connection, a 50 ft. indoor antenna is used as a sort of counterpoise. This counterpoise lowers the tuning limit somewhat.

The coils can be built on celluloid, bakelite or paper forms 3 ins. in dia. Use No. 18 or 20 S.C.C. or D.C.C, wire, spaced about 18 turns to the inch.

The large coil, L2, in Fig. 1, has 54 turns, tapped from the ground end, at 6, 15, 27, and 40 turns. This coil goes far below the broadcast band. For the real short-wave band the coil L2 should have 15 turns, tapped at 3, 6, 9 and 12 turns from the ground end. This coil, using a counter-poise goes up into the broadcast band **and separates stations better, with good volume, than the large coil.** It is not known how far this coil will tune below 46.96 meters.

Coil L1, the untuned, fixed, 11-turn primary, is made in the general manner described for coils L2; coil L1 must be made just small enough to slip inside and at the ground end of either of the coils which are used as L2. This primary is not a very important winding and is used but little, although, if loosely coupled when using a ground, it results in increased selectivity on loud signals.

The same station will come in on several taps, but use the one which places the station lowest on the tuning condenser setting for loudest signals.

To tune to the higher frequencies, move the right-hand switch, (marked "right" in Fig. 1) forward, clockwise, one to three taps before advancing the left-hand switch arm. The efficiency of this set seems to lie partly in the low-loss coils, but mostly in the one basic change in the circuit, in which the detector is connected permanently to the last turn (from ground) on the tapped coil.

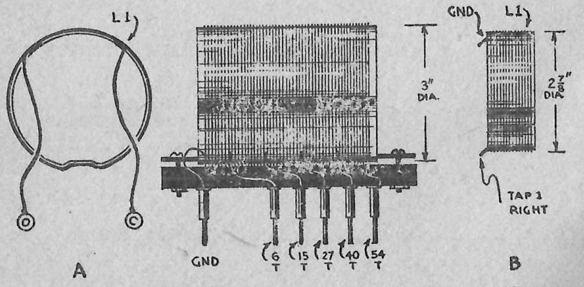


Fig 2. Sketch of the tuning coil. Two coils are needed to cover broadcast and short-wave bands.

List Of Parts *Required To Build This Crystal Set*

One crystal detector; tuning condenser, 500 mmf., C1; fixed condenser, .001 mf., C2; set of coils (see text) L1, L2; headphones; two tap switches, "left," "right;" 11 taps; baseboard, 7x12x5/8"; panel, 7x7x1/4"; hookup wire, screws, etc.

BUILDING 18 ELECTRONIC CIRCUITS WITH YOUR

ELECTRONICS LABORATORY

NO SCIENTIFIC BACKGROUND NEEDED.

If you can read you can build these 18 Electronic Projects.

All parts included — nothing else to buy.

Your Superex Electronics Lab Kit was designed to introduce you to the fascinating World of Electronics. Besides learning some of the fundamentals of electronics you will build 18 useful and enjoyable projects. The Lab Kit uses a very simple method of electronic construction so that even a beginner in electronics can successfully build the circuits in this kit. Your kit should include the following parts list:

Pegboard	Part 1	Antenna lead	Part 51
Loopstick with regen. coil	Part 11	Ground lead	Part 52
Variable capacitor	Part 76	3" jumper—8 ea.	Part 53
Earphone	Part 2	6" jumper—9 ea.	Part 54
Transistor	Part 31	9" jumper—3 ea.	Part 55
Transistor	Part 32	.1 capacitor—2 ea.	Part 77
Diode	Part 34	.005 capacitor	Part 78
Sun Battery	Part 33	5.6K resistor	Part 61
Battery and battery case	Part 21	100 K	Part 62
Key	Part 41	560K—2 ea.	Part 63

All of the parts are mounted on special bases and contain terminals which require no soldering. The only tool needed to complete all of the projects is a small screw driver which is used to connect the various wires on to these terminals. Each project is outlined on a separate building plan called a template. This template shows all of the parts, and all the interconnecting wires. Features in this kit are some of the latest advances in electronic components, semi-conductors. The semi-conductor components in this kit are the diode, the transistors and the sun battery. All the experiments build a piece of equipment using these semi-conductors. The diode, transistors and sun battery are the heart and brain of such modern electronic miracles as computers, rockets, guided missiles and space satellites.

In addition to the 18 projects that can be built with this kit, additional parts kits are available that can be added to this kit with which you can build additional circuits. Included with your Lab Kit is an application for membership in the Superex Lab Kit Club. Membership in this Club entitles you to all information and literature about new components and circuits as well as a member's special discount price. Fill this out and mail it for your free membership.

GENERAL INSTRUCTIONS

All the components for the 18 circuits are mounted on the peg board. Each component has a number stamped on it. There are also 18 separate templates, one for each experiment. Study each template so that you can identify the parts on it. The connections are made with the wires as shown on the templates. All of the circuits are assembled in this manner. When you have familiarized yourself with all these components, you will be ready to start building your first circuit. Remove all the components from the pegboard. Do not pull the parts themselves, always grasp the mounting to avoid any damage. Open the bag of small screws, and assemble one into each terminal.

Pierce the 4 round holes in the 4 corners of the template wth a pencil point. Lay the template flat in the center of the pegboard. Put an eyelet through each of the 4 pierced holes in the corner of the template, to secure the template to the board for the experiment. Pierce with a point, the component mounting holes as they are shown on this template. If the 4 corner eyelets were seated in the pegboard correctly, each of the holes you pierce will be directly over a hole in the pegboard. Each time you want to build another circuit all you have to do is use a different template. Mount the parts as shown on the template and follow the wiring. That's all there is to it.

PROJECT #1 GERMANIUM DIODE RADIO

Lay the template on the pegboard, and place the components in their correct positions. Screw the jumper wires from terminal to terminal as shown on the template. Make sure that seven jumper wires are used in this experiment. Note that there is an antenna and ground wire used. In any experiment where a radio is constructed a large antenna, and a good ground connection is very important. The larger the antenna, outdoor preferred, the better the reception. The Diode radio receives the signal from the antenna. The coil and variable capacitor "tune in" the wanted station. The germanium diode detects the radio signal. As there is no further amplification of the signal, the volume depends upon the amount of signal intercepted by the antenna. Hence the larger the antenna the louder the reception.

For an indoor antenna connect the wire to a large metal object such as a metal screen, a bed spring or the nickle plated finger guard on your telephone. For a ground, connect to a cold water pipe. For best results use an outdoor antenna. If this receiver, or any of the following circuits don't work, check to see that the correct components have been used, and that they have been correctly connected.

PROJECT #2 SIMPLE TRANSISTOR RADIO

Place the template on the pegboard and mount the correct parts and wire as shown. In this circuit a transistor is used as a detector and an amplifier. As this set uses a battery to supply power to the Transistor for amplification, it should produce a stronger signal than the Diode radio. Be sure the battery is connected with the plus and minus as shown.

PROJECT #3 SOLAR POWERED RADIO

Mount the template and parts and wire as shown. In this circuit power for the Transistor is supplied by a selenium solar cell. Be sure to watch the plus and minus connections when wiring the solar cell. This solar cell generates voltage when light shines on it. It works in sunlight, or artificial light, such as a fluorescent or an incandescent lamp. Solar cells such as this power the electronic equipment in our space satellites.

PROJECT #4 ADDING REGENERATION

Wire the correct components on the template as shown. In this circuit the Transistor is used as a detector and amplifier. But we use a special winding called a "Tickler" coil over the tuning coil. This coil feeds back some of the radio signal, so that it can be re-amplified and so add strength to the original signal. In this way the radio signal can be amplified several times repeatedly by the transistor. This happens so fast that we hear it only once, but much louder. This is a very efficient type of receiver. If too much of the signal is fed back for reamplification, the receiver will begin to squeal, or oscillate. The amount of radio signal that is fed back can be controlled by sliding the "Tickler" coil, back and forth over the tuning coil. The best location is in the position just before the receiver starts to squeal.

PROJECT #5 REGENERATIVE SOLAR POWER TRANSISTOR RADIO

Mount all parts, and wire as shown on the template. In this receiver power is supplied by the solar cell. Reception should be superior to the simple set in circuit #3. This is due to the added regeneration. This type of circuit (regenerative) was used for many years until the invention of the superhetrodyne receiver.

PROJECT #6 ADDING AMPLIFICATION

Mount all parts and wire as shown on the template. In this circuit, detection, or separation of the audible frequencies from the inaudible radio frequencies is performed by a germanium diode. This operation is similar to that of Project #1. But now we follow it with a transistor amplifier, so that this receiver will be more powerful than the simple Diode Radio.

PROJECT #7 SOLAR POWERED DIODE & TRANSISTOR RADIO

Mount and wire the parts on the template. In this set power is supplied by the solar cell. You can "turn it off" by blocking the light with your hand. You can supply less "sun power" by letting only some of the light through. Notice how the volume is affected by the amount of light falling on the sun cell.

PROJECT #8 TWO TRANSISTOR RADIO

Mount and wire the parts on the template. The first transistor operates as a detector, similar to the simpler circuit in Project #2. However we add a second transistor for more amplification. This results in more volume in the headphone. The first radios had simple tube amplifiers similar to this, and were only capable of headphone operation. Modern sets use two or more amplifier circuits and develop more power, so as to drive a loudspeaker. If you want to, you can make your set work with a loudspeaker by adding another amplifier stage. We have made up a small kit which contains all the extra parts needed, as well as the speaker. It is available from the dealer where your Electronic Lab was purchased.

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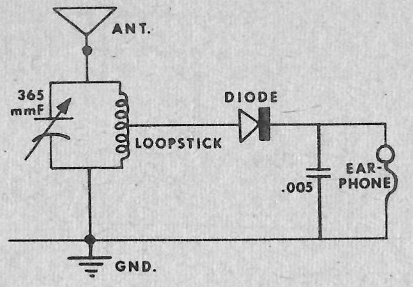

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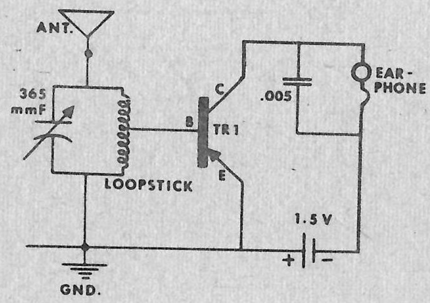

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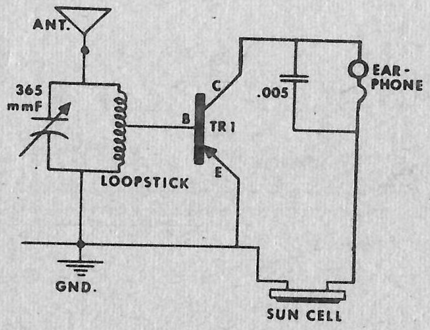

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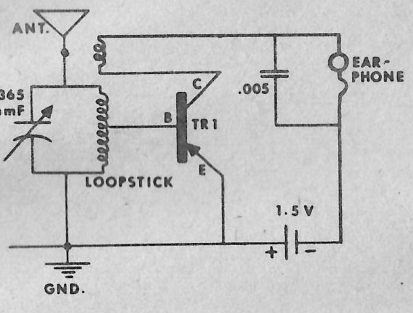
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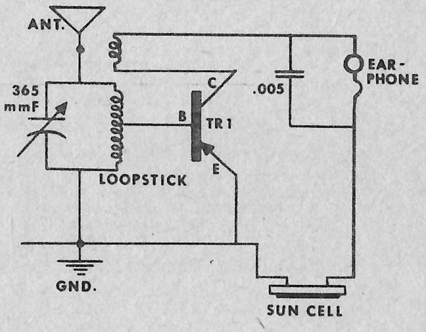
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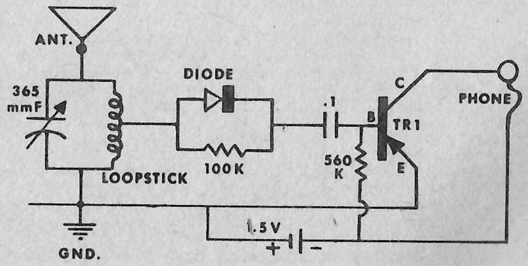
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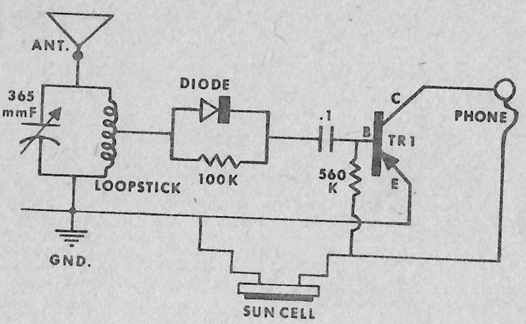
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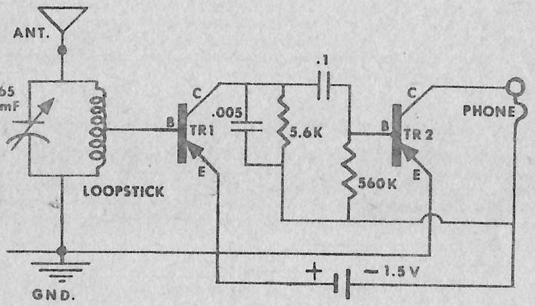
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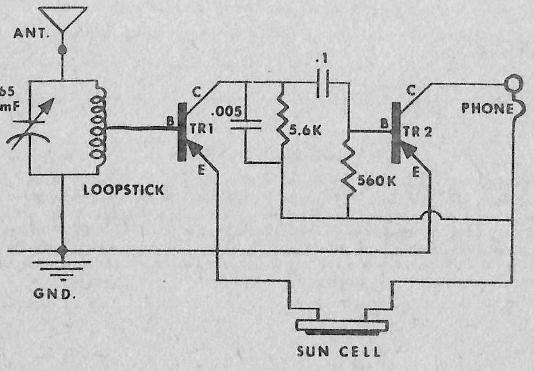
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PROJECT #9 SOLAR POWERED TWO TRANSISTOR RADIO

Mount all parts, and wire as shown on the template. This set obtains all its power from the light energy which is converted to electric power by the sun battery. Perhaps you noticed the odd shape of your sun battery. Wonder why? These batteries were designed to fit together (just like a jig-saw puzzle) on the outer surface of one of our country's space satellites.

If you want to wake up in the morning to music, you can, just place your sun battery near the window, eastern exposure preferred, and after the sun rises, your radio will start to play. But what if it's a cloudy day?

PROJECT #10 MORE SENSITIVITY AND POWER BY ADDING REGENERATION

Mount and wire the components on the template. In this circuit we add the "Tickler" coil to make a regenerative circuit. Operation is the same as explained in Project #4. This set should play louder than the set in Project 4 because it has an amplifier to increase the strength of the radio signal.

PROJECT #11 REGENERATIVE SOLAR POWERED TWO TRANSISTOR RADIO

Mount and wire the parts on the template. This circuit receives its power from the sun battery. Notice how it does not quite have as much volume as the set in Project #10. This is because the solar cell generates about 1/2 of a volt while the battery applies 1 1/2 volts to the circuit. You can add the power of the battery to the sun battery by connecting them in series. This is done by disconnecting the plus lead going to the sun battery. Place the battery on the pegboard. Connect the negative terminal of the battery to the plus terminal of the sun battery. Connect the wire you removed from the sun battery to the plus terminal of the battery. Now you have two volts operating your radio. The volume should increase as you shine light on the sun battery, providing you made the proper connections.

PROJECT #12 TWO TRANSISTOR & DIODE RADIO

Mount and wire the components on the template. This radio circuit is the most powerful one that you can build with this kit. It should get most of the local stations and even distant ones if your antenna system and ground connections are good. Study the schematic diagram. See if you can identify the parts with the symbols used in the schematic. See if you can trace the wiring. Go slowly, start with the antenna and follow each part. After you have followed each part and can trace it on the schematic, you have learned the language of the Electronics Engineer.

PROJECT #13 SOLAR POWERED TWO TRANSISTOR & DIODE RADIO

After successfully completing the previous 12 Projects, try to wire this one without using the template. Place the template on the table next to your pegboard. Follow the wiring as shown and see if you can do the job correctly. If not put the template on the board and wire as you did in the previous Projects. After you get it working, try to wire it without using the template. Once you have succeeded, try wiring the set following the schematic alone. Don't be discouraged if it doesn't work the first time. Go back over your work and "Troubleshoot" until you find your mistakes. You can be real proud of yourself once you can build from a schematic.

PROJECT #14 BUILDING AN OSCILLATOR

Mount the template and wire the parts shown. Basically you have built a two transistor amplifier, the output of #1 feeding into the input of #2. We then take the output from stage #2 and feed it back to the input of stage #1. We now have a completed loop, where the audio signal goes round and round. It is called oscillation. This oscillation is heard in the earphone as a tone, or whistle. The frequency of this tone is controlled by how fast the signal goes round and round, and this is controlled by electrical value of several of the components. Replace part #78 with part #77 and notice how the tone has changed. You can do several of your own experiments by substituting other parts for those originally used.

For example, using two jumper wires, connect the diode across the earphone, and notice the change of tone. Now, reverse the polarity of the diode and again connect it across the earphone. The tone is different, when the diode across the phone, is reversed. The resistance of the diode is different in one direction than it is in the other. This different "forward to back resistance" as it is called, changes the tone of the oscillator as it is placed across this earphone. This characteristic of the diode (offering high resistance to one polarity of voltage, and low resistance to the opposite polarity) enables it to rectify and detect.

PROJECT #15 LIGHT DETECTOR

Mount and wire the parts on the template. In this project the audio tone generator is used to detect light. A solar cell is used to power an oscillator. The frequency of this type of oscillator will vary with the supply voltage. The output voltage of the sun cell will depend upon the strength of the light shining on it, and the tone of the oscillator will change as the light changes. When there is no light the tone will stop. Hold the sun cell under different types of light . . . for example, an incandescent light, a fluorescent light, the sun, a flashlight, etc. Note the difference in tone using the different light sources. Why is there a hum as well as the whistle when the cell is held under a fluorescent light? You can use this circuit as an electronic alarm clock, to wake you up when the sun shines in the morning.

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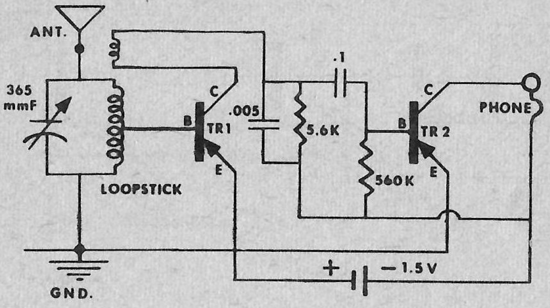

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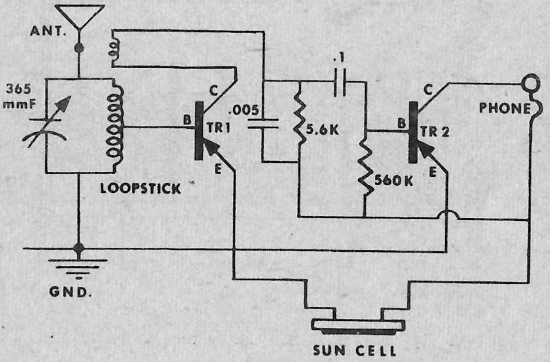

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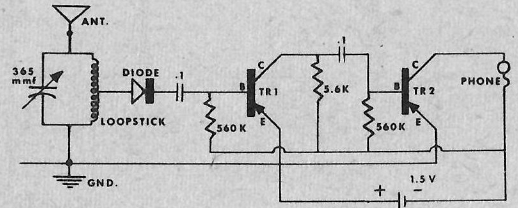

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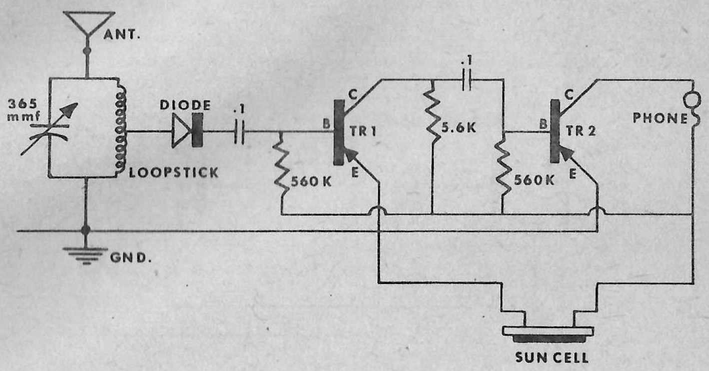

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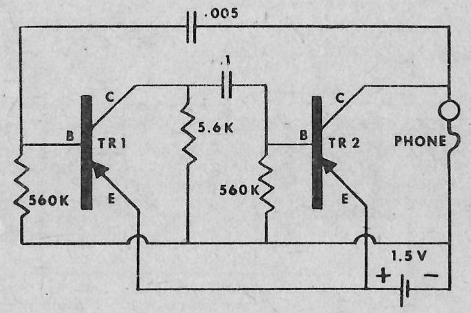

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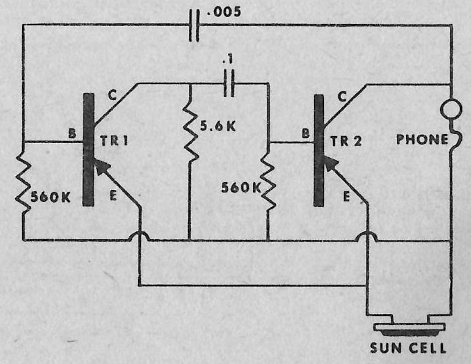

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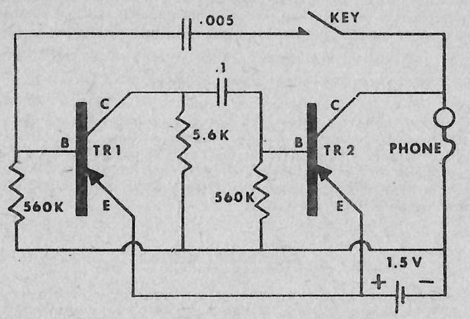

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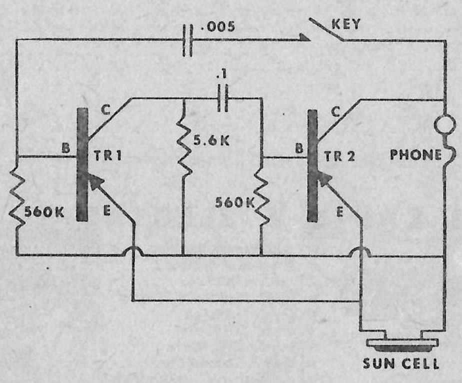

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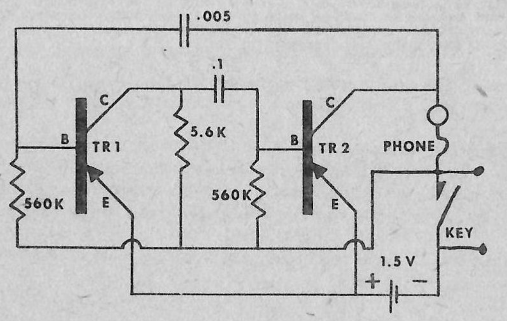


PROJECT #16 TELEGRAPHY (MORSE CODE)

Mount all parts and wire as shown on the template. This circuit is a code practice oscillator. On the template is a copy of the International Morse Code. This is the same code you frequently hear on short wave. The correct way to memorize the code, is by the sound. A dot sounds like di and a dash sounds like dah. So instead of memorizing dot-dash, memorize di-dah for the letter A. If you wish to practice with a friend you can obtain another key and earphone from your dealer. Wire the second key across the present key and the second earphone across the present one. This is called a parallel connection. You only need one oscillator.

PROJECT #17 SPACE TELEGRAPHY

Mount and wire the parts on the template as shown. This circuit is similar to Project 16 except that it is light operated. You can practice code, without using up your battery. Notice the phantom wire connected across your key. When you make this connection your oscillator will operate without using the key, so long as light falls on the solar cell. You can key this oscillator by stopping and starting the light with a flashlight. If your friend has his own Electronic Lab, you can set up to send messages to each other by using a beam of light. Depending on the strength and concentration of the light you can send messages across a room or even across a larger distance.

PROJECT #18 CONTINUITY TESTER

Mount all the parts and wire, as shown on the template. In this circuit we will make use of an audio oscillator to test electrical continuity. Bulbs and TV tubes have filaments, toasters and broilers have elements. You can test these as well as fuses, switches, small motors and electric irons. Connect the two wires from the key to the item being tested. If the item being tested is good you should hear a tone. If there is no tone, then the item has an open circuit and is not good. You can also test resistors or, high resistance circuits by a comparison method. Connect the 100K resistor, part #62 across the two leads, and listen to the tone. Press the key and notice the difference. Do the same with the 5.6K resistor, part #61. Notice the difference in tone. Now if you connected an unknown resistor, and it sounded the same as part 62, you would know it was close to 100K in resistance. This is a simple method that gives an indication of low or high resistance.

This Set Builds All Projects from #1 to #18.

BUILD 18 RADIO & ELECTRONIC ITEMS

- ★ 9 Different Radios
- ★ Transistor Radios
- ★ Transmitter
- ★ Solar Powered Circuits
- ★ Light Detector
- ★ Code Oscillator
- ★ Continuity Tester
- ★ Space Communication

Other Electronic Instruments

Home Course in
Radio & Electronics

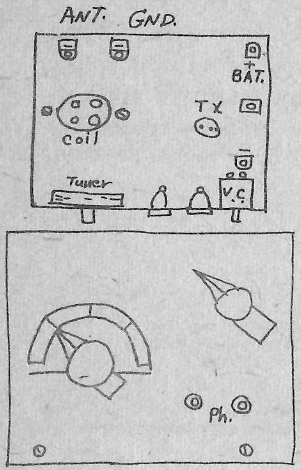
Build instruments worth $90.00 if bought separately! You don't have to spend hundreds of dollars for a radio course. This progressive educational kit is a method of learning while having fun of building instruments you can enjoy using. No knowledge of radio necessary. No other parts needed. Excellent background for TV. Used by schools in U.S. and other countries. No soldering necessary. Every circuit can be done quickly with only a screwdriver. Easy pegboard mounting. Parts can be used & re-used. Simple pictorial layout. Place diagrams on mounting board, insert parts and make connections. Newly developed set with transistor circuits, latest components. Attractive display box.

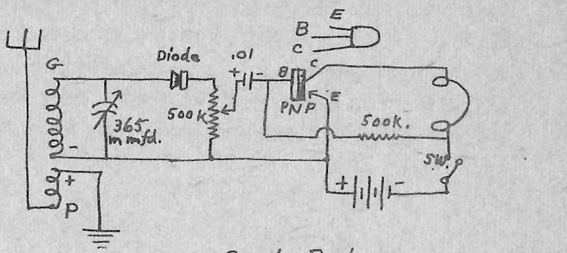
No. 6662. Radio & Electronics Lab. Postpaid $17.95

Order From: Johnson Smith Co., 6615 E. Jefferson, Detroit 7, Mich.

All Wave Battery Operated Transistor Radio

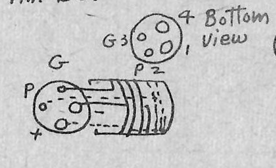
This set will bring in regular broadcasting stations plus short wave stations. This means that you can listen to foreign, ham, amateur, marine, etc. broadcasts. Diagram shows the wiring diagram (right) and also a top and front chassis view of the way the set is laid out (left). Data for winding coils is given. There are five coils each of which is used for a different wave band.





Coil Data

Meters	Secondary	Primary
20	4	3
40	10	5
80	22	10
160	65	12
H.F.-BC.	84	13



(#24 Enamelled Wire)

For Those Who Want to Buy the Complete Set

We can supply the above set in either kit or wired form. Prices are as follows:

No. 6553. All Wave Transistorized Radio. Complete kit of parts except for battery and earphone. Includes chassis. Price Postpaid $9.98

No. 6554. All Wave Transistorized Radio. Completely wired set, ready for use, except for battery & earphone. Price Postpaid $10.98

Order From: Johnson Smith Co., 6615 E. Jefferson Ave., Detroit 7, Michigan

Novice C-W Transmitter.

An intriguing application of the r-f transistor is in a simple, 80-meter crystal oscillator-type c-w transmitter. The circuit of a typical 1-transistor transmitter is shown in Figure 4-1. While this transmitter can give surprisingly good account of itself under favorable conditions, its very low r-f power output of approximately 15 milliwatts demands that it have an interference-free spot in the band.

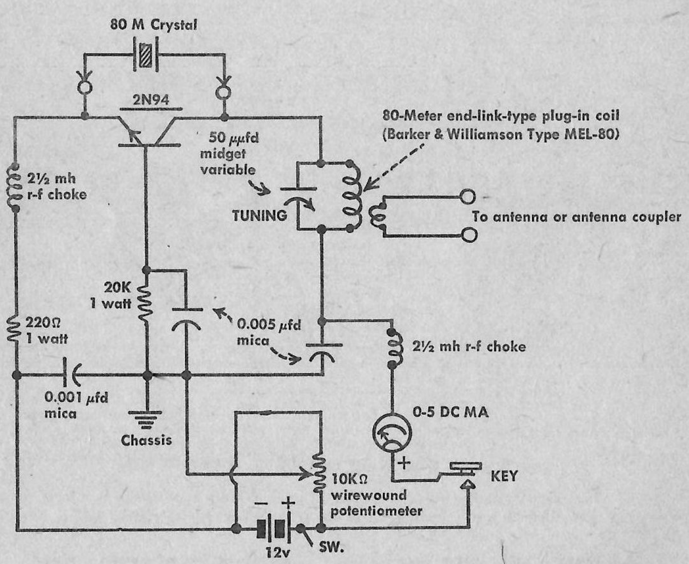


FIGURE 4-1—Novice C-W Transmitter.

An active crystal should be used. When tuning the collector tank to the crystal frequency, the collector current as indicated by the milliammeter will dip. However, this dip is not as deep as in a tube-type oscillator. The 10K-ohm potentiometer should be adjusted, with the key closed, for an off-resonance collector current of not more than 3 ma and so that oscillation starts readily when the key is operated rapidly.

Antenna loading should be adjusted to raise the resonant collector current to 3 milliamperes. Individual transistors may tolerate higher current *under full antenna load.*

Operation of the transmitter beyond the 80-meter band, with the 2N94 transistor, is not recommended.

A	• —
B	— • • •
C	— • — •
D	— • •
E	•
F	• • — •
G	— — •
H	• • • •
I	• •
J	• — — —
K	— • —
L	• — • •
M	— —
N	— •
O	— — —
P	• — — •
Q	— — • —
R	• — •
S	• • •
T	—
U	• • —
V	• • • —
W	• — —
X	— • • —
Y	— • — —
Z	— — • •

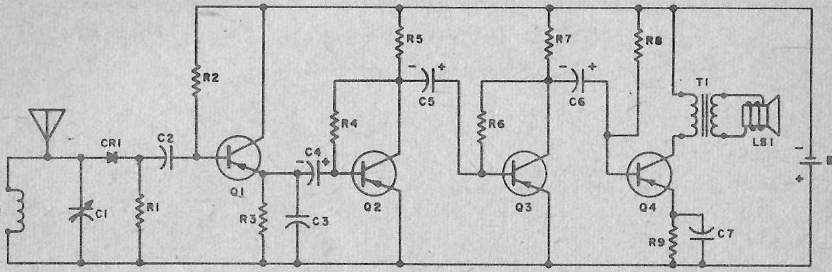
1	• — — — —
2	• • — — —
3	• • • — —
4	• • • • —
5	• • • • •
6	— • • • •
7	— — • • •
8	— — — • •
9	— — — — •
0	— — — — —

Period	• — • — • —
Comma	— — • • — —
Question mark	• • — — • •
Error	• • • • • • • •
Double dash	— • • • —
Wait	• — • • •
End of message	• — • — •
Invitation to transmit	— • —
End of work	• • • — • —

CRYSTAL RECEIVER

(formerly "Direct-Coupled Receiver")

This receiver circuit utilizes the gain of transistor stages to obtain the highest sensitivity possible from a simple crystal detector arrangement. The power gain of the transistors also permits the driving of a loudspeaker at the output. While the receiver provides more sensitivity than the conventional arrangement which uses only a tank circuit, crystal detector, and headphones, its sensitivity still does not approach that of a superheterodyne receiver. Nevertheless, it is a simple and inexpensive circuit to build and will give good reception for local stations.



CRYSTAL RECEIVER

The basic limitation in crystal receiver sensitivity is the noise level of the crystal itself. The conventional crystal detector circuit using headphones does not have enough gain to amplify the signal to the point where the noise is heard at a high level. Broadcast signals likewise have to be at relatively high levels, with respect to crystal noise to be heard with this type of circuit. Use of transistors provides enough gain between the crystal and the audio output device to enable one to hear broadcast signals down at the level of the crystal noise. The price one pays for this sensitivity is that the crystal noise must now be tolerated in addition to the signal.

The parallel resonant circuit, or so-called tank circuit, formed by L1 and C1 is used to provide station selectivity at the brodcast frequencies. With the capacitor entirely closed, the coil slug should be adjusted to bring in stations at the low end of the AM band (550 kc). With the coil slug left in this position, opening the capacitor plates will now tune the circuit

up to the high end of the band (1600 kc). Diode CR1 is a nonlinear device which provides demodulation of the broadcast carrier and its sidebands. The output of the diode which is passed through capacitor C2 now consists of the broadcast carrier frequency as well as the original modulating frequency.

The high input impedance of the Q1 emitter-follower stage provides good sensitivity by retaining a high Q in the tank circuit. Transistors Q2, Q3 and Q4 are all connected in the ground-emitter amplifier configuration. Resistors R2, R4, R6 and R8 provide bias; resistors R5 and R7 are collector loads; and capacitors C4, C5, and C6 provide interstage coupling. Capacitor C3 is used to suppress high frequencies in the amplifier. Since the amplifier has no gain at the broadcast frequencies, only the audio signal at the output of capacitor C2 is amplified. Transformation of the loudspeaker impedance to a reasonable value of collector load impedance is accomplished by output transformer T1.

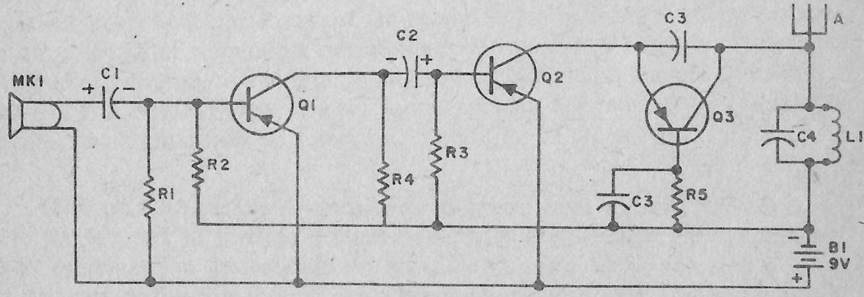
PARTS LIST

B1 — 6-volt battery
C1 — 0-365 mmfd tuning capacitor
C2, C3 — 0.02 mfd ceramic disc or paper
C4, C5, C6 — 1.0 mfd electrolytic, 15 v
C7 — 25.0 mfd electrolytic, 15 v
CR1 — Sylvania 1N64 or 1N34 diode
L1 — Ferri-loopstick antenna coil
LS1 — 3-6 ohm loudspeaker
Q1, Q2, Q3, Q4 — Sylvania 2N1265 transistor
R1, R8 — 470 k, ½ w
R2, R4, R6 — 220 k, ½ w
R3, R5, R7 — 2.2 k, ½ w
R9 — 100 Ω, 1 w
T1 — Argonne AR-133 or equivalent

WIRELESS MICROPHONE

This wireless microphone has many versatile uses, and is particularly well suited for those with an inclination toward detective work. It is essentially an oscillator operating in the AM broadcast band, such that its output can be detected by standard broadcast receivers. A microphone at the input is used to pick up voice signals. These are then amplified and used to modulate the transmitter. Since all of the parts are small, the unit can be packaged in a small volume. This enables the user to hide the device easily for concealed-microphone applications. Use of a short antenna increases the range of the transmitter. Since a very fine wire can be usd for this function, it can readily be concealed under table cloths, along base boards, and the like. When used with conventional ac-dc superheterodyne receivers, a range of 20 feet is typical. Since the range is not appreciably affected by wooden and even concrete walls, applications for the circuit are almost unlimited. In addition to its undercover uses, the unit can also be used wherever a one-way intercom is required. In a typical situation it could be used as a remote baby monitor. Another use to which the circuit can be put is that of a "phone-oscillator." For this application, a phonograph cartridge is connected to the circuit in place of the microphone. By connecting both the microphone and phone cartridge to the circuit through a switch, and using the two inputs alternately, a complete radio program can be simulated.

Transistor Q3 is the active element of the oscillator stage. Other important components of this stage are capacitors C3 and C4, and inductor L1. The short 2 or 3 foot antenna wire is connected to the collector of Q3 as shown. The frequency of the oscillator is determined principally by capacitor C4 and inductor L1. Transistors Q1 and Q2 are both used in grounded-emitter configurations for audio amplification. Their function is simply to amplify the low-level audio at the input to a level which is adequate for amplitude-modulating the oscillator stage. When using ceramic phonograph cartridges with relatively high output levels, the first stage of gain is not needed and connection is made directly to capacitor C2, coupling into the second stage. It should be noted that the circuit does not, however, provide for record equalization.



WIRELESS MICROPHONE

To use the circuit, tune the broadcast receiver to a place in the band where there is no radio signal present. Now adjust L1 in the transmitter circuit by moving the slug in or out of the coil. When the transmitter frequency nearly matches that of the receiver, a whistle will be heard. Tune to the middle of this whistle, and the circuit is ready to operate. Since length and placement of the antenna will have a slight effect on the oscillator frequency, these should not be changed once the circuit has been adjusted.

PARTS LIST

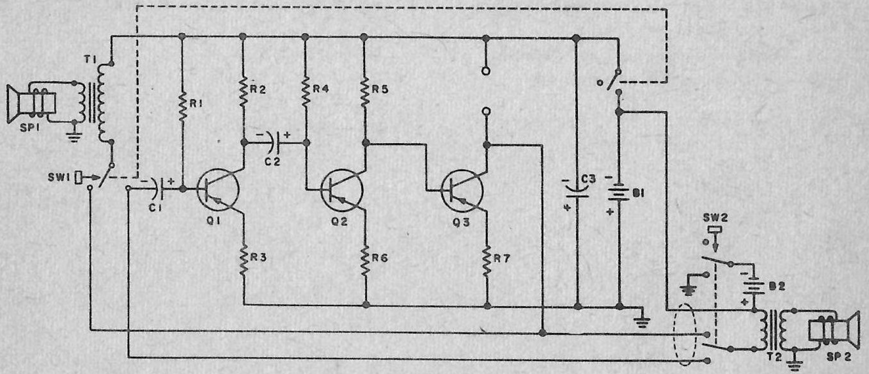
B1 — 9-volt battery
C1, C2 — 5 mfd electrolytic, 15-volt
C3 — 100 mmfd mica or tubular ceramic
C4 — 360 mmfd mica or tubular ceramic, or 0-365 mmfd adjustable
C5 — 0.02 mfd paper or disc ceramic
L1 — Ferri-loopstick antenna coil
MK1 — Virtually any microphone — magnetic or capacitive type
Q1, Q2 — Sylvania 2N1265 transistor
Q3 — Sylvania 2N1264 transistor
R1 — 9.1 k, ½ w
R2 — 470 k, ½ w
R3 — 150 k, ½ w
R4 — 560 k, ½ w
R5 — 47 k, ½ w

INTERCOM

Frequently, it would be quite convenient if it were possible to speak with a person in another part of the house. The intercom is a system which has two "stations" between which two people may carry on a conversation. The system described here consists of a master station and one remote station.

The master station contains a speaker, input-output transformer, amplifier, battery, and "push-to-talk" switch. The remote station contains a speaker, input-output transformer and a second battery. If the positive terminal of each battery is grounded to a water pipe or radiator, only three wires need be run between the master and remote station.

When neither switch is pushed, both B1 and B2 are disconnected and the primary windings of both transformers are connected to the amplifier output. To make a call from the master station, it is only necessary to push SW1. This switch connects B1 to power the amplifier and also connects the secondary winding of T1 to the input of the amplifier. SP1 now acts as a microphone. The signal from the speaker is coupled through T1 and C1 to the base of Q1. The amplified signal at the collector of Q1 is coupled through C2 to the base of the second common emitter amplifier stage Q2. The output of Q2 is direct-coupled to the base of Q3. The collector current of Q3 flows through the primary winding of T2 and produces a sound output from SP2.



INTERCOM

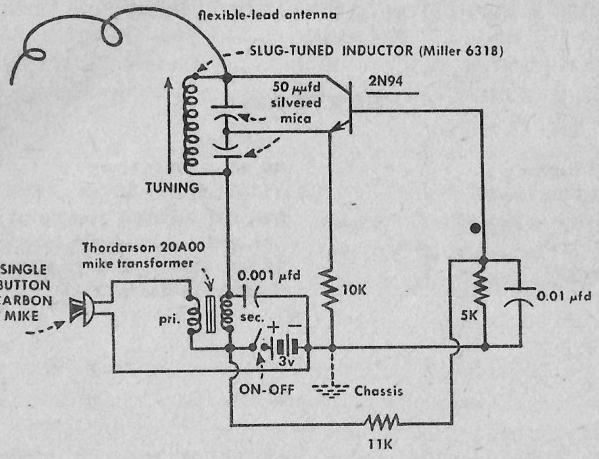
Pushing SW2 connects B2 to the amplifier and connects the primary of T2 to the amplifier input, allowing the person at the remote station to speak.

PARTS LIST

B1, B2 — 9-volt battery
C1, C2, C3 — 25 mfd, 12-volt
Q1, Q2, Q3 — Sylvania 2N1265
R1, R4 — 560 k, ½ w
R2, R5 — 4.7 k, ½ w
R3, R6 — 100 Ω, ½ w
R7 — 1000 Ω, ½ w
SW1, SW2 — DPDT pushbutton switch
SP1, SP2 — 3.2 Ω, 4-inch PM speaker
T1, T2 — 2000 Ω to 3.2 Ω, output transformer, Lafayette Radio TR 93

We wish to thank Sylvania Electric Products Inc. for permission to reproduce diagrams, circuits, and information from their books. For best results, use Sylvania diodes, transistors, semiconductors and other electronic products.

Wireless Mike.



The wireless microphone circuit operates somewhat the same as the phono oscillator described in the preceding Section 6.1, except that the mike permits voice announcements to be made through the radio receiver tuned to the circuit frequency. Like the phono oscillator, the wireless mike may be tuned through the standard broadcast band.

A 2N94 fixed-tuned r-f oscillator is employed. By using a carbon microphone, sufficient audio power is obtained on speech to modulate the oscillator directly without an audio amplifier stage. Some carbon mikes may require less bias than the 3 volts shown. If "packing" of the carbon granules occurs the bias should be reduced.

The oscillator is tuned by means of the screwdriver-adjusted slug in the coil. The antenna, like that of the phono oscillator, is a short length of flexible, insulated wire (ac-dc antenna hank). A short vertical antenna, such as a 1- to 2-foot length of stiff wire, also may be used as a transmitting antenna.

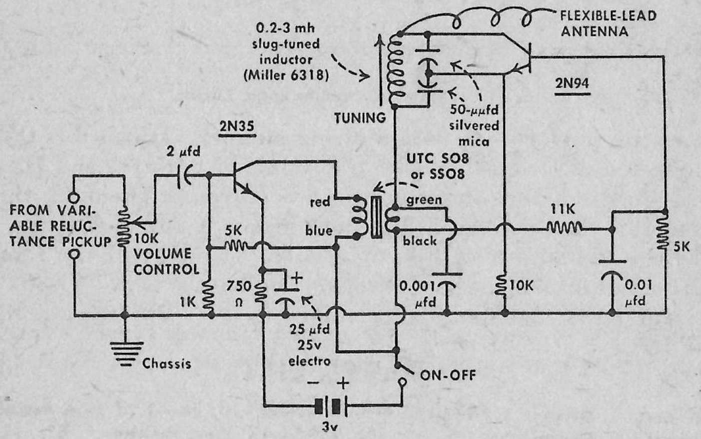
Wireless Phono Oscillator.

A battery-operated phonograph oscillator for wireless transmission into a broadcast receiver is attractive because it requires no connection to the power line and is hum-free. Transistors make possible economical battery operation of this device.

Figure is the circuit of a simple phono oscillator unit employing a 2N94 fixed-tuned r-f oscillator and 2N35 modulator. A short length of flexible, insulated wire (ac-dc antenna hank) serves as the transmitting antenna.

The oscillator frequency is adjusted by means of a 0.2-3-millihenry slug-tuned inductor. The frequency may be shifted throughout the broadcast band to any clear spot on the receiver dial. The oscillator is a Colpitts-type circuit.

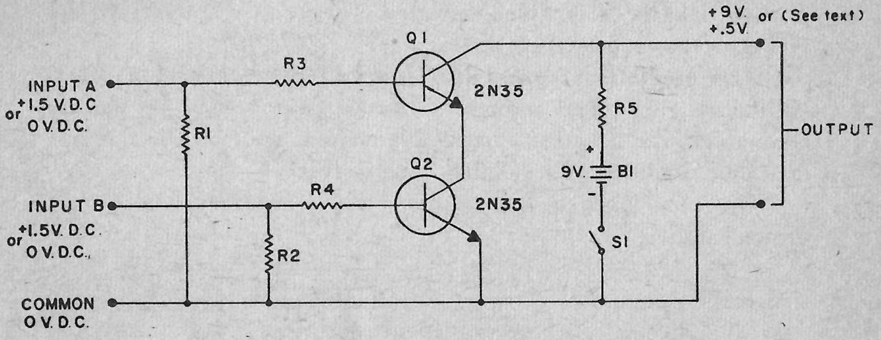
Operated from a self-contained 3-volt battery, the circuit draws 1.6 ma.



COMPUTER LOGIC "AND" CIRCUIT

Description of Operation:

This circuit can be used to make electronic combination locks or control devices in pre-arranged sequences. A device to test the intelligence of friends could be implemented by this circuit. The circuit is typically called an "AND" circuit, since the circuit provides an output when both inputs are applied simultaneously.



Computer Logic Circuit.

The circuit performs in the following manner. Transistors Q1 and Q2 are connected in series, therefore the inputs of both Q1 and Q2 must be forward biased before current can flow through them in this series manner. It is for this reason that both inputs A and B must be at +1.5 volts before the output will go to .5 volts. If either of the inputs is at 0 volts the output will be at +9 volts. The output is a +9 volts because no current flows through R5, therefore it is at the same potential as battery B1.

PARTS LIST

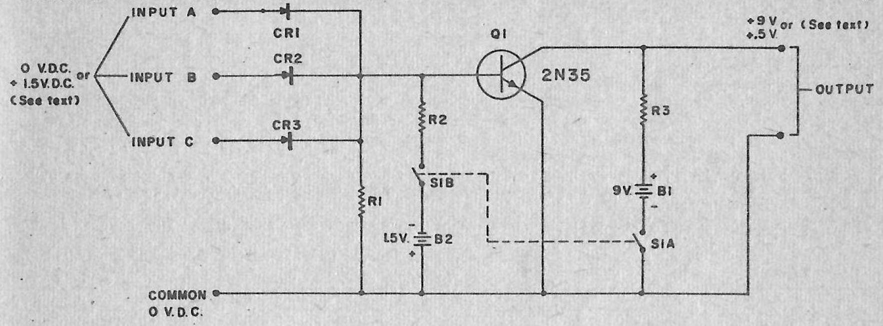
B1—9V. Battery, Burgess #2N6 with snap terminals or equivalent.
Q1, Q2—Sylvania 2N35 Transistor.
R1, R2, R3, R4—1.2K ½w. Resistor.
R5—1K ½w. Resistor.
S1—S.P.S.T. Toggle Switch.

COMPUTER LOGIC "OR" CIRCUIT

Description of Operation:

This circuit is a fundamental building block for all digital computers. With this circuit and the previously discussed computer circuit, one can impliment a giant brain. The circuit is usually referred to as an "OR" circuit since the circuit provides an output when any of its inputs are activated.

This configuration performs in the following manner. Each of the input terminals is connected to a voltage of 0 volts or +1.5 volts. With terminal A at 1.5 volts and terminals B and C at 0 volts, the following occurs. With the anode of diode CR1 positive with respect to the cathode, the diode becomes forward biased. Now the potential at the base is at +1.5 volts which is sufficient to make the transistor Q1 conduct. The collector will be at +.5 volts. With all the input terminals at 0 volts the transistor doesn't conduct and so the collector is at +9 volts. With any of the input terminals at +1.5 volts the output will be +.5 volts.



Computer Logic Circuit or Building Block.

PARTS LIST

B1—9V. Battery, Burgess #2N6 with snap terminals or equivalent.
B1—1.5V. Battery, Burgess #2R or equivalent.
CR1, CR2, CR3—Sylvania 1N456 Diode.
Q1—Sylvania 2N35 Transistor.
R1—2.7K ½w. Resistor.
R2—5.6 ½w. Resistor.
R3—1K ½w. Resistor.
S1—D.P.D.T. Toggle Switch.

CONSTRUCTION AND APPLICATIONS OF SOLAR CELLS

The Solar Cell is a self generating barrier layer type consisting of a metal base on which is coated SELENIUM and other metals. When light strikes the sensitive surface of the SOLAR Cell, an electro-motive force is generated between the front and back surfaces of the cell. By proper circuit design, actuating suitable mechanisms, the Selenium or Solar cell may be utilized to measure light intensity, or to perform duties as the light intensity varies. This Solar cell is ruggedly constructed and is mechanically strong, compact, light sensitive, and is not susceptible to shock or vibration to the extent of being shatterproof.

The life of this Solar Cell is practically unlimited when operated under normal conditions, and without undue overload. This Solar Cell converts sunlight into electrical energy. This energy is used directly or with amplification. depending on the application. Examples of direct use of sun cells are the light meter and sensitive relay useage. In both of these cases, the cells when exposed to light are capable of furnishing sufficient electricity to power the light meter or sensitive relay. Figure 1 shows the relative response of the cell to light. Figure 2 shows a basic circuit utilizing the cell output without amplification. A balanced circuit is used employing two cells with compensated rheostats to eliminate light variations due to voltage fluctuations. Other versions of balanced circuits are available and practiced in colorimetric work such as vitamin determination, blood count, acidity measurement. Those circuits are so designed that a predetermined value of illumination will create sufficient power to actuate the relay. Circuits such as these are used for opening doors, counting, and many other purposes. Since the output of the cell is in the order of microwatts, amplification is essential in many applications. One of the simplest methods of increasing the sensitivity of a Solar Cell is to apply a small amount of DC potential in the order of two volts in the reverse direction as shown in Figure 3. For such a circuit, the general sensitivity or micro-amps output per foot candle illumination is increased approximately 50%. This is due to the fact that at increased illumination the internal resistance of the cell decreases. The output of such a cell is sufficient to operate a sensitive relay. Figure 4 shows a still larger output circuit. Since the DC amplification of such a low impedance source as a self generating Solar Cell is rather difficult, the light falling on the cell may be interrupted by a sector disc and the resulting pulsating current generated by the Solar Cell amplified by an audio amplifier.
Sunlight will generate approx. 2 ma of current under a 100 ohm load. At 100 feet, candle cells will generate approx. 60 micro-amps under a 55 ohm load. Voltage in sunlight is approx. $\frac{1}{2}$ v. at 100 feet; candles approx. .35 v.
The metal back of the cell is positive (+) and the front surface lead is negative (-)

FIGURE #1

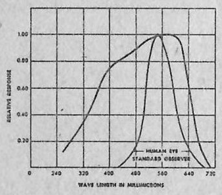


FIGURE #2

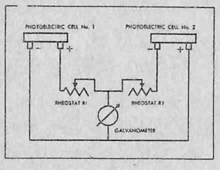


FIGURE #3

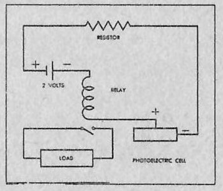
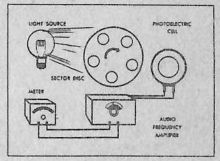


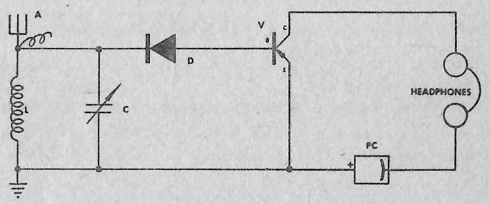
FIGURE #4



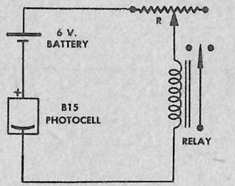
About $\frac{1}{2}$ volt will be produced when the cell is exposed to bright sunlight. Sun powered radios are a recent inovation and the following schematic is one of the simplest ways to use this power for operating a broadcast receiver.

PC=sun battery cell.
L=Grayburne Ferri-Loopstick.
C=360 mmfd. variable capacitor, standard variety.
D=Point-contact germanium diode

V=PNP junction transistor; Radio Receptor RR125, GE 2N76, Hydro-Aire CQ-1, RCA type 2N77 or equivalent.
A=External antenna.



Internal resistance of the cell is practically 100% when not exposed to light. The internal resistance drops when exposed to light. This photo-conductive principal permits the cell to be used as a valve. Introduce a bucking voltage of about 6 volts or less and if the cell is blacked out, no current flows. Exposed to light, the cell permits current to flow. You can utilize this principal with the following circuit, as a counting device or operate relays for a number of uses.



Photoconductive

Relay type SV/1C, 8500 ohm coil

2000 ohm pot

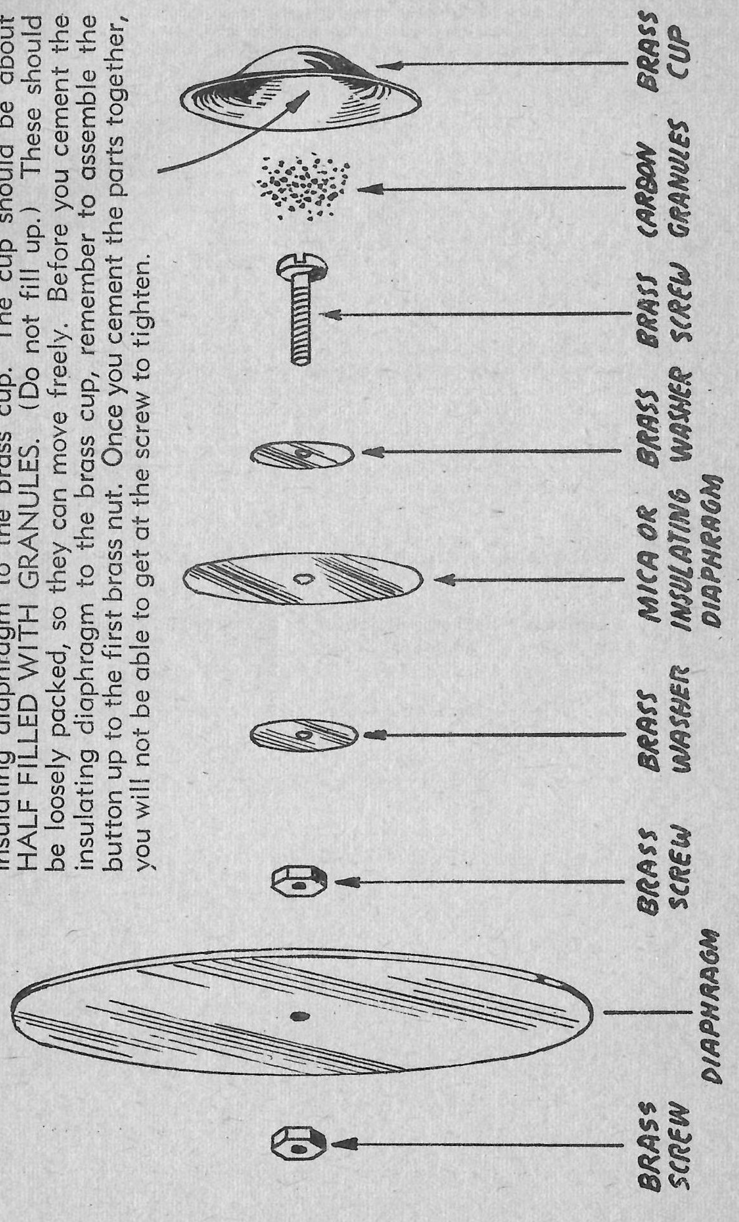
RF power output meter can be easily made using a micro-ameter in series with the photo-cell. Common practice is to use and incandescent bulb with an inductive load introducing this near the final tank coil of a transmitter. With the photo-cell so arranged that the light falls on it from the lamp, the current generated by the photo-cell registers directly on the microameter. This setup performs well and is far more accurate than guessing at the brilliance of the lamp. Actual layout and construction details are left to the builders taste.

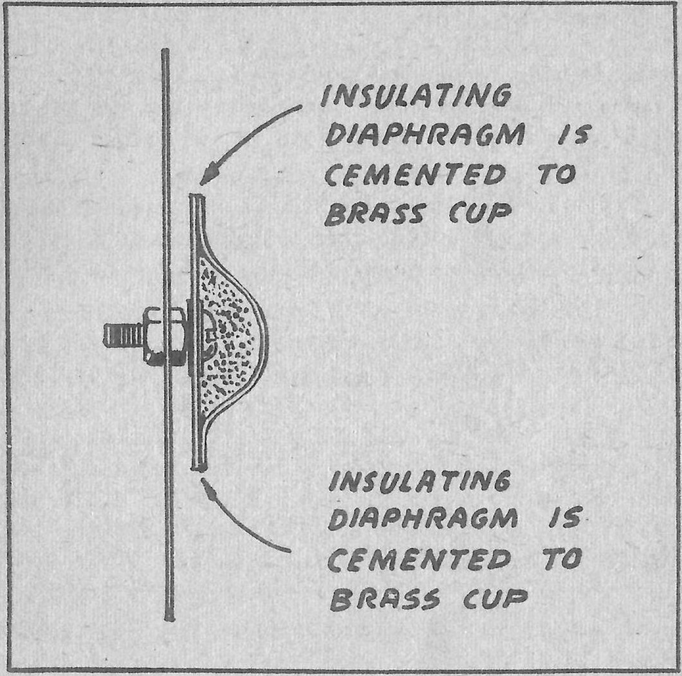
Low Priced Sun Battery & Photo-electric Cell

No. 4924. Sun Battery & Photocell. Price Each Postpaid 50c
Quantity Price: 3 for $1.35; 6 for $2.50
(Each additional cell increases total output, just like extra batteries)

Order From: Johnson Smith Co., 6615 E. Jefferson Ave., Detroit 7, Mich.

The assembly of the button is quite easy, and the only difficulty you may have is inserting the carbon granules and cementing the insulating diaphragm to the brass cup. The cup should be about HALF FILLED WITH GRANULES. (Do not fill up.) These should be loosely packed, so they can move freely. Before you cement the insulating diaphragm to the brass cup, remember to assemble the button up to the first brass nut. Once you cement the parts together, you will not be able to get at the screw to tighten.




INSULATING DIAPHRAGM IS CEMENTED TO BRASS CUP
INSULATING DIAPHRAGM IS CEMENTED TO BRASS CUP

General Instructions on the Microphone Button

You will find it easy to build a Microphone Transmitter Button. This particular device lends itself admirably for use in radio and electrical circuits, and in view of the fact that many do not realize to what important uses such a button can be put, it is advisable to cover the use of this little transmitter in its various fields so that one will easily see how each and every one of the systems are applicable to radio uses. In the illustration a transmitter button has been taken apart so as to show its internal construction.

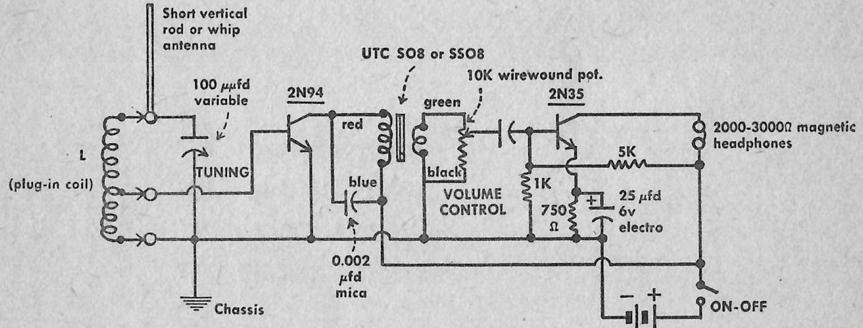
For those who want to build their own Microphone Transmitter Button, it will be seen from the exploded view of the button, that it really is quite simple. The one illustration shows all the parts necessary for the complete construction of the button. The assembly of the button is illustrated in the smaller drawing.

Ready Made Microphone Button, 50c. See Price List Page

Phone Monitor.

Figure 4-2 shows a radiophone monitor suitable for 80- and 160-meter use and offering higher sensitivity than the common diode-type monitor. Close coupling to the transmitter is not required.

A 2N94 tuned detector and 2N35 audio amplifier are employed. With a short vertical whip or rod antenna (2 to 3 feet high), a husky headphone signal is obtained. Operation is reliable at distances up to several hundred feet from the transmitter. Thus, the monitor is entirely safe to the operator.



PLUG-IN COIL (L) SPECIFICATIONS

160 Meters. 95 turns No. 30 enamelled wire closewound on 1"-diameter form. Tap 30th turn from ground end.

80 Meters. 46 turns No. 24 enamelled wire closewound on 1"-diameter form. Tap 12th turn from ground end.

FIGURE 4-2—Phone Monitor.

D-C power is supplied by a 3-volt battery. Two 1½-volt Size-D flashlight cells connected in series will give long service life, even on a continuous operating basis, since the total current drain is only approximately 2½ milliamperes.

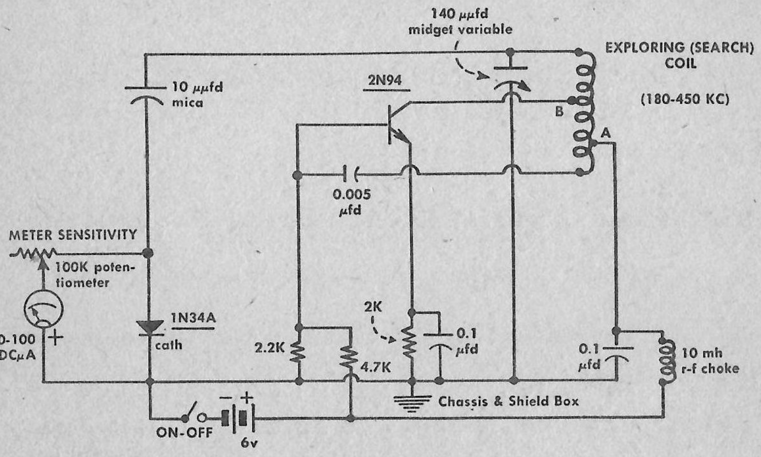
The monitor is built easily into a small metal, radio utility box no larger than a small camera.

Simplified Metal Locator.

Figure 6.3 is the circuit of a simple, low-frequency r-f oscillator for locating hidden metallic objects at a distance of 1 to 2 feet. The distance over which the device is effective depends upon the size of the object and the kind of material in which it is buried. This device is handy for locating pipes, wiring, nails, etc. in walls, ceilings, and under floors.

The modified Hartley oscillator is tunable from 180 to 450 kc by means of the 140-uufd variable capacitor. The higher frequencies in this range seem to be more effective for locating small-sized objects. The indicator is an r-f voltmeter comprised of the 0-100 d-c microammeter, 100K METER SENSITIVITY potentiometer, 1N34A germanium diode, and 10 uufd coupling capacitor. With the battery switched-on, the potentiometer is set for full-scale deflection of the meter. If a metal object then comes within the field of the search coil, it will detune the oscillator slightly and cause the meter reading to increase or decrease sharply. When the metal passes out of the field, the deflection returns to its original level.

The search coil should be mounted so that it may be swung around to present either its side or bottom to the area suspected



EXPLORING COIL SPECIFICATIONS:

230 turns No. 32 enamelled wire closewound on 4"-diameter, 2½" high form. Tap A 40 turns from low end. Tap B 100 turns from low end.

to contain hidden metal. The tuning capacitor may be set for any frequency in the tuning range. However, as stated earlier, the higher frequencies should be used when small-sized objects are suspected.

This metal locator is *not* satisfactory for underground treasure hunting, although it is capable of picking out a sewer top or car track that has been covered with a relatively thin topping of asphalt. The reason is that the r-f output of the 2N94 transistor is too low for deep penetration into the soil.

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